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1858. *Taxocrinus multibrachiatus* Lyon and Cassiday (labelled in most Amer. collections *Forbesiocrinus meeki* Hall). Amer. Journ. Sci., vol. xiii.
1861. *Vaxocrinus lyoni* Hall (*Cyathocrinus lyoni*) Meek and Worthen. 1868 (*Barycrinus lyoni*). Proc. Acad. Nat. Sci. Phil. Syn. *Cyathocrinus hexadactylus*.—Chas. S. Beachler.

The Carboniferous Genus *Stereosternum*.—The reception of a nearly entire specimen of the remarkable reptile *Stereosternum tumidum* Cope, from San Paolo, Brazil, through Professor Orville Derby, enables me to add a number of characters to those already known. The sternal region presents a large coracoid on each side posteriorly, and a transverse element anteriorly. Whether the latter is clavicle or the transverse limbs of a large interclavicle, is uncertain. The foramen of the humerus is *external*. The carpus consists of a radiale, a large intermedium, and a small ulnare; a large centrale and four tarsalia, the external related to two metapodials. The thumb is more robust than the four other digits. The neck is moderately elongate, and includes nine vertebræ besides the atlas. The vertebræ have robust transverse processes and slender cervical ribs. The skull is elongate and acuminate, and its bones are apparently fragile. Little of its structure can be made out. The teeth are slender, acute, and nearly straight, and are planted in (?) shallow alveoli.

The characters of the scapular arch differ from those of the Theromorpha. This character, with the different tarsus and rib-articulation, indicates that Dr. Baur's order Proganosauria, proposed for this type, is well founded. The lacertilian character of the ectepicondylar foramen of the humerus must be also remembered.—*E. D. Cope*.

MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—In an exceedingly interesting paper recently published, Dr. A. Lagorio² discusses some of the fundamental principles relating to the nature of the glassy base of porphyritic rocks, the succession of crystallization in rock-magmas, and the classification of rocks. He emphasizes the thought that the geologist must ask the aid of chemistry and physics in solving the problems which present themselves to him. He must obtain all the light that these kindred sciences can lend him, and in this light must approach the hidden mysteries locked up in the depths of rock-masses, and must examine them with the critical eyes not merely of the geologist, but of the chemist and physicist as well. We may then, he thinks,

¹ Edited by DR. W. S. BAYLEY, Madison, Wisconsin.

² Miner. u. Petrog. Mitth., viii., 1887, p. 422.

obtain some knowledge as to the origin of rocks, their relations to each other, and the causes of the great variation in structure observed in them. The paper is full of interesting facts and valuable suggestions. It begins with a discussion of the theory proposed by Rosenbusch to account for the successive crystallization of rock-constituents. It has been recognized for a long time that the minerals in a rock did not crystallize in the inverse order of their fusibility, as might at first thought be expected. The order in which the separation takes place bears no relation to the temperature of solidification. Rosenbusch regards the acidity of the minerals as the important element governing their crystallization. He states, as a general law, that the order of the separation of the minerals from a rock-magma is inversely as their acidity. Roth¹ has called attention to the very many exceptions to this rule, and in its place gives seven empirical laws of association. Lagorio refuses to accept Rosenbusch's law, and proceeds to investigate the subject by chemical methods. He analyses the glassy ground-mass and crystallized portions (*Ausscheidungen*) of artificial and natural glasses, and thoroughly discusses the figures thus obtained. He finds that the *sodium-silicates* possess a stronger tendency to crystallize from a molten magma than do the corresponding isomorphous potassium compounds. Sodium is concentrated in the crystallized portions, and potassium in the residual ground-mass. With this discovery as his governing principle, Lagorio examined rocks varying widely in their composition and structure. Upon discussing the figures which these analyses yield, the following conclusions are reached: (1) A rock-magma is a more or less completely saturated solution of different silicates. (2) The normal glass—that in which all the other silicates are dissolved, or, more precisely, the last substance to crystallize from a molten rock or glass-magma—is a silicate of the composition $K_2O.2SiO_2$. This compound is capable of holding in solution silica, magnesia, lime, alumina, and iron-oxides, and from this solution the minerals separate out in a certain order, which is determined by the different amounts of the elements in solution and their affinity for each other, the sodium-bearing minerals always crystallizing before the corresponding potassium-bearing compounds. (3) The order of solubility of various compounds in the normal glass is: potassium compounds; sodium-silicates; calcium-, magnesium-, iron-salts; and, finally, oxides of the heavy metals, the latter being the most soluble. The greatest amount of supersaturation obtains in the case of the most soluble compounds. From such a supersaturated solution—a rock-magma—minerals separate in the order of the excess of saturation,—viz., the oxides of the heavy metals first, then the silicates of the heavy metals, then sodium-silicates, and, finally, quartz and the potassium-

¹ J. Roth, *Chem. Geologie*, ii. pp. 49 and 69.

silicates. (4) The stronger tendency of sodium compounds to separate, as compared with potassium compounds, is seen in the case of the sodium-bearing hornblendes and augites. (5) Sanidine crystallizes from a molten magma only after the relative proportions (molecular) of K_2O and Na_2O in it become as 2:1. (6) The affinity of the elements for each other is an important factor in determining the order of crystallization. Calcium and sodium are widely found associated in the same minerals, magnesium and sodium rarely. Potassium, on the other hand, occurs frequently with magnesium, rarely with calcium, etc. (7) The order of crystallization is as follows: Oxides, pure Fe-silicates, Mg-silicates, Fe + Mg-, Mg + Ca-, Mg + K-, Ca-, Ca + Na-, Na-, K-silicates, and, finally, silica, which latter, however, frequently separates out before or contemporaneously with the potassium-silicates. (8) The composition of a second generation of minerals in a porphyritic rock is dependent upon the composition of the residual magma at the time of their solidification, and not upon a recurrence of the conditions under which the corresponding minerals of the first generation were produced. (9) The more or less complete development of the constituents of the ground-mass of a rock is but slightly, if at all, dependent upon the rapidity with which the original magma cooled. In addition to these results obtained by a study of the composition of the different portions of a rock, Lagorio also discusses several theoretical questions of general interest. He believes that the hornblende and mica in rocks were formed in the presence of water¹ and under pressure. The existence of basic hydrogen in many members of the mica group, he thinks, would indicate this fact. He also criticises many of Rosenbusch's statements as to the origin of the plutonic rocks, which, Lagorio says, were originally eruptive or intrusive, but in their present condition are metamorphic. In conclusion, attention is called to the system of classification proposed by Rosenbusch² for the massive rocks, and some of the hypotheses upon which it is based are shown to have no foundation in fact. The paper, as a whole, is an admirable one, and bears evidence of care in its preparation. It is to be hoped that it will act as an incentive to more work in the direction of experimental and chemical geology.—In a late number of the *Quarterly Journal of the Geological Society* Mr. Rutley³ has a paper on the rocks of the Malvern Hills, which, upon the occasion of its delivery before the society, gave rise to considerable debate. Mr. Rutley describes in detail the structure of the Malvern Hills, and gives two plates illustrating his views. The rocks of the range he divides into three classes,—eruptive, foliated, and stratified. The first consists principally of diorites, diabases, gabbros and granites, and felsites. These he describes

¹ Cf. American Naturalist, 1886, p. 160.

² Ib., February, 1887, p. 172.

³ August, 1887, p. 481.

singly. The most notable fact in their consideration is the supposed occurrence of topaz in the felsite and the grouping of little crystals of this mineral in such a manner as to bring out the pearly structure of the rock. The second class the author "is inclined to regard . . . as probably being more or less altered volcanic tuffs, or as sedimentary rocks mainly composed of eruptive material derived from the disintegration of rocks of a dioritic or syenitic character." Various reasons are given for this conclusion, none of them, however, being based on petrographical evidence. The stratified rocks embrace tufas and quartzite.—Bergeron¹ mentions the occurrence of hyperite in the carboniferous of Aveyron, near the village of Arvieu. It contains intergrowths of hypersthene and diallage, in which $\infty P \infty$ of the hypersthene is parallel to $\infty P \infty$ of the diallage. The large crystals of hypersthene exhibit pressure effects to such a degree that the broken pieces of this mineral have been separated from each other, and between them have been injected portions of the granulitic ground-mass. The minerals comprising this ground-mass are round, and possess no crystal outlines. The smaller grains consist of pyroxene, which tends to group itself around the larger crystals of hypersthene, forming an aureole. The larger grains of the ground-mass are labradorite:—E. Cohen² has recently called attention to the fact that andalusite occurs much more frequently as an accessory mineral in normal granite than had formerly been supposed. He mentions five granites from the Vosges, Croatia, the Schwarzwald, and Vogesen, each of which contains more or less andalusite, but in quantity too small for isolation. In an aplitic tourmaline granite from Alt Zschillen, near Wechselburg, in Saxony, Cohen finds it in sufficient quantity for isolation, but not for analysis. The mineral occurs in isolated columnar and acicular forms, and not in groups, as in the case of contact rocks and the crystalline schists.

Mineralogical News.—After experimenting upon the effect of high temperatures on the optical properties of *faujasite* crystals, Rinne³ concludes that this mineral is normally regular in crystallization. When exposed to the air it begins to lose water and becomes uniaxial, breaking up at the same time into eight individuals, each extending from an octahedral face into the centre of the crystal. These individuals are positively refractive, and their optical axes are perpendicular to the octahedral faces. When heated in contact with the air the difference between the index of refraction of the ordinary ray and that of the extraordinary ray becomes less and less as the temperature increases, until at $150^{\circ} \omega = \epsilon$. At this temperature the mineral loses 16.83

¹ Comptes Rendus, cv., 1887, p. 247.

² Neues Jahrb. f. Min., etc., 1887, ii. p. 178.

³ Ib., i. p. 17.

per cent. of water,—equivalent to twelve molecules. Above 150° the mineral remains uniaxial, but refracts negatively. When thin sections of the mineral are allowed to cool in the air they revert to their original condition of positive refraction, but if cooled under balsam (protected from the air) they remain negatively refractive. Faujasite, therefore, passes from the regular system to a crystallographic system of a lower degree of symmetry upon loss of part of its water. *Heulandite* from Andreasberg, on the contrary, is monoclinic under ordinary conditions. When heated to 150° it loses two molecules of water and becomes orthorhombic. It regains its original condition if submitted to the action of the atmosphere. This peculiarity of the Andreasberg heulandite is supposed by Rinne to be due partly to the large amount of strontium it contains, and its consequent approach in composition to brewsterite, which is known to possess peculiarities similar to those described. Jannasch, who has examined the heulandite from Andreasberg,¹ finds that it does in reality contain a large amount of strontium. —Sandberger² thinks that, whatever might be the origin of *graphite*, it can certainly not have been produced in any igneous way. In studying Ceylon specimens of this mineral, he has discovered pieces on the $\infty P \infty$ faces of which are numerous little *rutile* crystals cutting each other at an angle of 60° , in the manner so frequently seen in mica. Had the temperature at the time of the formation of these crystals been high, he argues, they would have been reduced to the metallic state in the presence of such great excess of carbon. He also finds that many of the minerals associated with the graphite are covered with a coating of this mineral. Among the minerals thus covered may be mentioned quartz, orthoclase, mica, and apatite. Upon removing the outside shell of graphite from around the apatite, this mineral was seen to be marked with the outlines of the rutile needles imbedded in the graphite. This, says Sandberger, is an indication that the latter mineral was formed before the apatite had become hard.—In an article on the minerals of the Tyrol Cathrein³ describes *grossularite* crystals, which, when broken open, are seen to consist of alternate zones of garnet and bluish calcite, of which the internal zones of garnet differ from the external zones both in color and composition. He examines also the so-called *paragonite* from Greiner (Zillerthal), and finds it to possess the ideal composition of talc. Cathrein also describes pseudomorphs of *fassaite* and *garnet* after *gehlenite*. The garnet pseudomorphs here described are the first known cases of the pseudomorphic origin of garnet. According to Klein and Jannasch,⁴ the *ullmanite* (NiSbS) crystals from Löl-

¹ Neues Jahrb. f. Min., etc., 1887, ii. p. 39.² *Ib.*, p. 12.³ Miner. u. Petrog. Mitth., viii., 1887, p. 400.⁴ Neues Jahrb. f. Min., etc., 1887, ii. p. 169.

ling (Carinthia) and from Sarrabus (Sardinia) possess the same chemical composition. The mineral from Lölling, however, crystallizes in the inclined hemihedral division of the regular system, while the Sarrabus occurrence is parallel hemihedral. —On *barite* crystals from the dolomite, near Volpersdorf, the four new planes ∞P_5 , $3P_\infty$, $5P_\infty$, and $\frac{1}{4}P_2$ have been detected by Traube.¹ —Patton² studies crystallographically the *hornblende*, *oligoclase*, and *titanite* crystals in the druses of the Schrieshiem diorite. —Igelström³ describes the occurrence, of braunite and hausmannite from the Sjögrube, in the Gouvernement of Oerebro, Sweden. —Ch. Lory⁴ notes the occurrence of microscopic crystals of *albite* in various limestones and marbles from the Western Alps. Their origin, he thinks, is connected in some way with the specific nature of the calcareous deposits and with the conditions which produced their crystallization.

BOTANY.⁵

Character of the Injuries produced by Parasitic Fungi upon their Host-Plants.⁶ —The first and most general injury which is produced upon plants by parasitic fungi results in consequence of the essential character of the fungus. Green plants have the power of converting inorganic materials into food for themselves. Fungi have not this power, but depend for their food entirely upon materials that have been previously elaborated by some green plant. Parasitic fungi take their food from their host while it is yet alive. The consequence to the plant, therefore, is a loss of food, a withdrawal of formed nutritive material, resulting, to greater or less extent, in starvation. In individual cells the contents usually suffer the greater injury, but the wall is also injured, as when penetrated by the haustoria, or suckers, — *e.g.*, upon the mycelium of *Peronospora*. But the special office of the haustoria is to absorb nutriment from the cell-contents. In some cases, as the above, the cell may live to be the continual prey of the parasite, and in some cases the cell is killed.

(2) While the food-supply of the plant is reduced, its power to replenish it is at the same time impaired, — *i.e.*, in case the fungus grows upon the green parts, as it does most frequently. The passage of light to the cells may be obstructed. The white moulds, or mildews, must obstruct it to some extent, black moulds growing over the surface, much more. The latter may occur either as true parasites, or as saprophytes upon "honey-dew."

Impaired nutrition weakens the physiological power of the chlorophyll. The life of the cells preyed upon is frequently

¹ Neues Jahrb. f. Min., etc., 1887, ii. p. 69.

² *Ib.*, p. 261.

³ *Ib.*, p. 8.

⁴ Comptes Rendus, cv., 1887, p. 99.

⁵ Edited by Prof. CHARLES E. BESSEY, Lincoln, Nebraska.

⁶ Read before Section F, A. A. A. S., August, 1887.